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Research Article

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Effect of organic manures and *Azospirillum* on productivity and economics of maize (*Zea mays* L.)

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Summary

A field experiment was conducted during the *Kharif* season of 2013 at Agronomy Research Farm, School of Agricultural Sciences and Rural Development (SASRD) Nagaland University, Medziphema, to study the effect of organic manure and *Azospirillum* on productivity of maize (*Zea mays* L.) under the agro climatic condition of Nagaland. The experiment was laid out in RBD replicated thrice with seven treatments *i.e.* FYM @ 10 t ha^{-1}, vermicompost @ 5 t ha^{-1}, pig manure @ 5 t ha^{-1}, FYM @ 10 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed, vermicompost @ 5 t ha^{-1} +*Azospirillum* @ 20 g kg^{-1} seed, pig manure @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed and control. The plant height, number of green leaves $plant^{-1}$, stem thickness (cm), and leaf area index were recorded highest with application of FYM @ 10 t ha^{-1} followed by FYM @ 10 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed. FYM @ 10 t ha^{-1} has also produced highest yield attributing characters like cobs weight (120.51 g), number of grain rows (34.84), length of cob (15.29 cm), grain weight (81.66 g), grain yield(1.82 t ha^{-1}), straw yield (3.01) and B:C ratio 2.5.

Key words : Biofertilizers, FYM, Maize, Pig manure, Vermicompost

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Introduction

Maize (*Zea mays* L.) is one of the most important staple food crops of the world and ranks only next to wheat and rice. It has a tremendous potential as food for human, feed for livestock and for industrial and pharmaceutical sectors as well. By virtue of its immense potentiality maize is also known as the 'Queen of cereals'. It is a high calorie cereals, rich in carbohydrates and proteins and is fairly good source of iron, phosphorus and vitamin-B complex. In North Eastern India the area and production of maize is 196.9 thousand ha and 1297.6 thousand MT, respectively (MoA, 2012).Maize possesses tremendous potential in terms of feed for the dairy, poultry and piggery industries. In order to increase the production and productivity of maize, Government is promoting area expansion for maize in view of serious competition from other food and cereal crops. Maize is an important cereal crop in Nagaland after to rice having high potential for large scale production. Maize crop has been valued as food, fodder and feed and remained as a mainstay of Indian agriculture in general and in Nagaland. Area and production of maize in Nagaland was recorded at 68.67 thousand ha and 134.65 thousand MT, respectively. In Nagaland district wise, Tuensang district is the highest maize growing district covering an area of 10.11 thousand ha with a production of 19.91 thousand MT (Govt. of Nagaland, 2013).

Farm yard manure application to the crop is being practice for long period. Well decomposed FYM in addition to supplying plant nutrients acts as binding material and improves the sol physical properties. Beneficial effects of earthworms and their casts were known as Darwin's era. But the potential of vermicompost to supply nutrients and to support beneficial microbes is being recognized recently. Vermicompost is rich source in humus forming microbes and nitrogen fixers and drying of the vermicompost does not deteriorate the microbial population. In recent years, the potential of FYM and vermicompost to supply nutrient and enhance beneficial microbes for faster decomposition is being recognized widely both in field crops and horticultural crops. Vermicompost is a potential source of organic nutrient due to the presence of readily available plant nutrients, growth-enhancing substances, and a number of beneficial micro-organisms like nitrogen fixing and P solubilizing organisms. Since a number of micro-organisms are in close association with earthworms and vermicompost, enriching vermicompost with rock phosphate may enhance multiplication of beneficial microbes and the P solubilizing organisms present and are expected to react with rock phosphate and convert the insoluble phosphate to plant available forms. Such vermicompost will have an added advantage in crop production. Biofertilizers plays a very significant role in improving the soil fertility by fixing atmospheric nitrogen, both, in association with plant roots and without it, solubilising insoluble soil phosphates and produce plant growth substance in soil. Proper application of biofertilizers increases the crop yield by 10-15 per cent under field condition, Besides, the yield of succeeding crops are also increased in measurable quantity. Since fertilizer consumption of Nagaland state is very low as compared to rest of India (Govt. of Nagaland, 2013). Therefore, keeping these facts into consideration the present investigation was taken up to find out the suitable source of nutrient for sustainable production of maize in Nagaland.

Resource and Research Methods

A field experiment was carried out in the Experimental Research Farm of School of Agricultural Sciences and Rural Development (SASRD), Nagaland University campus, Medziphema during the *Kharif* season 2013. The research plot was located at an altitude of 310 meters above mean sea level with the geographical location at 25^0 45' 43'' North latitude and 95^0 53' 4'' East longitude. The soil of the experimental field was sandy loam in texture, well drained, acidic in reaction (pH 4.6), low in organic carbon (0.33%), medium in available N (351.22 kg ha^{-1}) P (19.23 kg ha^{-1}) and high in available K (330.56 kg ha^{-1}). The experiment was laid out in RBD replicated thrice with seven treatments *i.e.* FYM @ 10 t ha^{-1}, vermicompost @ 5 t ha^{-1}, pig manure @ 5 t ha^{-1}, FYM @ 10 t ha^{-1} + *Azospirillum*@20 g kg^{-1} seed, vermicompost @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed, pig manure @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed and control. Each plot received identical cultural treatments in terms of ploughing, cultivation, seed rate and disease control. Healthy and clean seed of RCM 1-1 sown on 25th May, 2013 at a spacing of 60 cm row to row and 25 cm plant to plant and seed were sown at the depth of 4-5 cm. Well decomposed FYM @10 t/ha was applied 15 days prior to sowing while pig manure and vermicompost @ 5 t/ha was incorporated 7 days prior to sowing in each plot. So that well decomposition of organic manures would be taken place for the crop and thoroughly incorporated into the soil. Biofertilizers (*Azospirillum* and *Phosphetica*) was applied as seed treatment just before sowing. The crop was harvested at proper maturity from all the plots separately after 90 days of sowing. The harvested plant from each plot were labeled and threshed separately. Seeds were cleaned and sun dried and weight was recorded for yield data. Various observations were recorded on weed parameters and crop parameters. Analysis of variance for factorial Randomized Block Design was worked out as per the standard procedure given by Gomez and Gomez (1984) and the significance was tested by F-test.

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect on growth attributes :

The data observed regarding the effect of different organic manures and *Azospirillum* on growth attributes of maize are presented in Table 1. A close scrutiny of the data revealed that all nutrient sources had significantly higher values in respect to growth attributes over control. FYM @ 10 t ha^{-1} (T_1) recorded the highest growth attributes *viz.*, plant height, green leaves, LAI and stem thickness and which was statistically at par with FYM

@ 10 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed (T_4) in respect to all growth attributes while in the case of plant height it was at par with T_3 and T_6 and significantly superior to over rest of the treatments in all the growth stages. Table 1 also showed that lowest growth attributes was observed in control (T_7) plot. The finding is in accordance with Chandankar *et al.* (2005) who found out that application of FYM at 0 to 5 t ha^{-1}, N:P:K rates (90:45:22.5, 120:60:30 and 150:75:37.5 kg ha^{-1}), increases the plant height and with the highest NPK rate showed 34.1 per cent higher grain yield over the lowest yields and with low plant density produced taller plants, with broader and heavier ears. This finding was also in accordance with Naik *et al.* (2012) with the application of FYM @ 12.5 t ha^{-1} + biodigester liquid manure equivalent @ 150 kg N ha^{-1} recorded significant increase in growth attributing characters like plant height, number of leaves per plant, leaf area, leaf area index per plant,

Table 1 : Effect of organic manures and *Azospirillum* on growth attributes of maize

Treatments	Plant height (cm)	Green leaves (no./plant)	LAI	Stem thickness (cm)
T_1 - FYM @ 10 t ha^{-1}	228.08	7.36	1.27	1.86
T_2 - Vermicompost @ 5 t ha^{-1}	172.37	6.20	1.02	1.66
T_3 - Pig manure @ 5 t ha^{-1}	219.47	5.76	0.99	1.73
T_4- FYM @ 10 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	225.88	7.03	1.18	1.76
T_5- Vermicompost @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	171.07	6.76	1.11	1.50
T_6- Pig manure @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	214.36	6.10	1.03	1.53
T_7-Control	98.59	6.10	0.92	1.30
S.E. ±	11.38	0.20	0.03	0.06
C.D. (P=0.05)	35.07	NS	0.10	0.18

NS= Non-significant

Table 2 : Effect of organic manures and *Azospirillum* on yield attributes of maize

Treatments	Cob weight (g/cob)	Cob length (cm)	Grain weight per cob (g)	No. of seed rows
T_1 - FYM @ 10 t ha^{-1}	120.51	15.29	81.66	34.84
T_2 - Vermicompost @ 5 t ha^{-1}	94.20	14.75	73.14	29.89
T_3 - Pig manure @ 5 t ha^{-1}	101.15	14.70	72.66	30.88
T_4- FYM @ 10 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	109.61	15.19	80.27	32.01
T_5- Vermicompost @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	84.06	15.18	66.68	31.22
T_6- Pig manure @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	101.70	14.68	78.83	23.11
T_7-Control	68.29	9.90	50.83	13.51
S.E.±	4.67	0.46	2.83	2.28
C.D. (P=0.05)	14.39	1.42	8.73	7.04

Table 3 : Effect of organic manures and *Azospirillum* on grain and straw yield and economics of maize

Treatments	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Net return (Rs. ha^{-1})	Benefit: cost ratio
T_1 - FYM @ 10 t ha^{-1}	1.82	3.01	52290	2.5
T_2 - Vermicompost @ 5 t ha^{-1}	1.56	2.62	21970	0.5
T_3 - Pig manure @ 5 t ha^{-1}	1.73	2.30	49850	2.5
T_4- FYM@ 10 t ha^{-1} *Azospirillum* @ 20 g kg^{-1} seed	1.68	2.88	46350	2.2
T_5- Vermicompost @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	1.18	2.09	6670	0.1
T_6- Pig manure @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed	1.39	2.85	35990	1.8
T_7-Control	0.78	1.42	15810	1.0
S.E.±	0.12	0.02	-	-
C.D. (P=0.05)	0.36	0.07	-	-

leaf area duration and dry matter accumulation.

Effect on yield attributes :

The yield attributes of maize showed significant increase in all the treatments over control (Table 2). The highest values of yield attributes were recorded in FYM @ 10 t ha^{-1} (T_1), which was at par with T_4 in all respect while it was significantly superior over the control. Table 2 also showed that T_1 was at par with T_2 and T_3 in this respect. This may be due to the availability of nutrients from the given treatment. This finding is in accordance with Ram *et al.* (2006), who reported that through the application of 50 per cent chemical fertilizer + 50 per cent through farm yard manure recorded enhancement of growth and yield attributes such as cobs length, cob girth, grain weight per cob, shelling percentage and test weight as well as grain and stover yields which was recorded upto 180 kg N ha^{-1}. Naik *et al.* (2012) also reported that application of FYM @ 12.5 t ha^{-1} + biodigester liquid manure equivalent @ 150 kg N ha^{-1} recorded significant increase in yield attributing characters grain weight per cob, number of seeds per cob, number of rows per cob, cob length, grain yield and stover yield compared with remaining treatments.

Effect on yields and economics :

The data recorded on the effect of organic manures and *Azospirillum* on the grain and stover yield in maize is presented in Table 3. The grain and stover yield in different treatments showed a significant increase in all the treatments over control. Among the different nutrient sources, the highest grain and stover yield was recorded in FYM @ 10 t ha^{-1} (T_1) treated plot and the lowest was recorded in control (T_7). The grain and stover yield in FYM alone @ 10 t ha^{-1} (T_1) treated plot was found to be statistically at par with FYM @ 10 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed (T_4). This result is in accordance with the finding of Jayaprakash *et al.* (2003) who reported that the grain yield of maize was significantly affected b the application of organic manures. This finding is also in accordance with Singh (2004) that with the combined application of farm yard manure and fertility levels and farm yard manure and manganese significantly increased the grain and stover yield of maize. The maximum grain and stover yield was obtained under the treatment with 112.5 kg N + 40 kg P_2O_5 ha^{-1} level of fertility, 15 kg Mn ha^{-1} and 10 tonnes farm yard manure ha^{-1}. The highest net return (Rs.52,290) was recorded in FYM @10 t ha^{-1} (T_1) and lowest (Rs. 6,670) was recorded in vermicompost @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} seed (T_5) treated plot. The highest benefit cost ratio (2.5) was recorded in FYM @ 10 t ha^{-1} (T_1) and pig manure @ 5 t ha^{-1} (T_3), respectively and the lowest (0.10) was recorded in vermicompost @ 5 t ha^{-1} + *Azospirillum* @ 20 g kg^{-1} (T_5) treated plot.

Literature Cited

Chandankar, M.M, Ghanbahadur, M.R. and Shinde, V.S. (2005). Yield and economics of maize (*Zea mays* L.) as influenced by FYM, N.P.K. and plant density. *Ann. Plant Physiol.*, **19**(2): 172-174.

Gomez, K.A. and Gomez, A.A. (1984). *Statistical procedure for agricultural research.* Ed. 2nd, p. 574. John Wiley, New York, U.S.A.

Govt. of Nagaland (2013). *Statistical handbook of Nagaland,* NAGALAND, INDIA.

Jayaprakash, T.C., Naglikar, V.P., Pujari, B.T. and Setty, R.A. (2003). Effects of organics and inorganics on yield and yield attributes of maize under irrigation. *Karnataka J. Agric. Sci.*, **16**(3) : 451-456.

Naik, K.P.S., Mavarkar, N.S., Naik, T.B., Krishnamurthy, N. and Sowmyalatha, B.S. (2012). Effect of farm yard manure and biodigester liquid manure on growth and yield of maize (*Zea mays* L.) *Crop Res*, (Hisar), **44**(3):279-282.

Ram, Vishram, Singh, R.N. and Singh, Kalyan (2006). Studies on integrated use of FYM, nitrogen and sulphur, yield attributes and yield on winter maize (*Zea mays* L.). *Plant Archiv.,* **6** (2) : 749-752.

Singh, Jagmohan (2004). Combined effect of FYM, manganese and fertility levels on grain and stover yield of maize (*Zea mays* L.). *J. Eco-Physiol.,* **7** (3/4) : 121-124.

Webliography

MoA (2012). Ministry of agriculture, Govt. of India. *www.Indiastat.com.*